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wherein the alignment patterns have a sectional shape of one of a triangular shape, a trapezoidal shape and a semi-circular shape, and wherein the alignment patterns are formed outside optically effective regions of said first and second diffraction gratings.

#### REMARKS

In view of the following remarks, Applicants request favorable reconsideration of the above-identified application.

Claims 1-20 remain pending in this application, with Claims 1-4, 7, 8, 11, 15, 16, 19 and 20 being independent. By this Amendment, Applicants have amended Claims 1-4, 7, 8, 15, 16, 19 and 20.

Applicants note that the Office Action indicates that should Claims 1, 2, 6, 7 and 8 be found allowable, Claims 15-20 will be objected to as being a substantial duplicate thereof. Applicants, however, submit that those two groups of claims are patentably distinct. Specifically, the first group (Claims 1, 2 and 6-8) recites that the diffraction grating and the alignment pattern are formed integrally on a substrate. The second group (Claims 15-20) merely recites that the diffraction grating and the alignment pattern are formed on a substrate. Accordingly, Applicants submit that an objection under 37 C.F.R. § 1.75 would be inappropriate.

Claims 1-9 and 15-20 stand rejected under 35 U.S.C. § 103 over U.S. Patent No. 5,847,877 (Imamura, et al.) in view of U.S. Patent No. 5,208,700 (Harris, et al.). Claims 10-12 stand rejected under 35 U.S.C. § 103 over the Imamura, et al. and Harris, et al. patents in further view of U.S. Patent No. 5,629,804 (Tomono). Applicants traverse these rejections.

As recited in independent Claims 1-4, 7 and 8, Applicants' invention is directed to a diffractive optical element which includes (i) a first diffraction grating and an alignment pattern integrally formed on a first substrate and (ii) a second diffraction grating and an alignment pattern integrally formed on a second substrate. The gratings are accumulated with a space therebetween and are positioned so that the alignment pattern on the first substrate engages the alignment pattern on the second substrate. Independent Claims 15-20 are similar to independent Claims 1-4, 7 and 8, but the diffraction gratings and alignment patterns are not integrally formed on the substrates, as discussed above.

As recited in independent Claim 11, Applicants' invention is directed to a method of manufacturing a diffractive optical element including a step of forming, upon a substrate, a first diffraction grating pattern and an alignment pattern. The method also includes preparing a mold having (i) an alignment pattern to be engaged with the alignment pattern formed on the substrate, and (ii) a second diffraction grating pattern. In addition, the method includes positioning the first diffraction grating pattern on the substrate and the second diffraction grating pattern to be spaced with respect to each other by engaging the alignment pattern of the substrate with the alignment pattern of the mold.

The Imamura, et al. patent is directed to a diffractive optical element having first and second layers. Applicant submits that that patent does not describe an optical element in which a space is provided between first and second diffraction gratings. Instead, the Imamura, et al. patent describes a structure in which plural diffraction gratings are accumulated, but not spaced.

The Harris, et al. patent is directed to a plurality of diffractive optical lenses. The Office Action cites this document as describing the use of alignment markings.

Applicants acknowledges that that patent states that alignment markings may be used to align the diffractive optical lenses, but submits that the patent does not describe alignment patterns that engage each other.

The Tomono patent is directed to a diffraction grating having a substrate and a resin layer. The Office Action merely cites this patent as describing forming diffraction gratings using a mold. Applicants submit that this patent does not remedy the deficiencies discussed above with respect to the Imamura, et al. and Harris, et al. patents.

Accordingly, Applicants submit that the Imamura, et al., Harris, et al. and Tomono patents, taken alone or in combination, fail to disclose or suggest at least the features of a first diffraction grating and alignment pattern formed on a first substrate and a second diffraction grating and alignment pattern formed on a second substrate, the first and second gratings being accumulated with a space therebetween and being positioned so that the alignment pattern on the first substrate engages the alignment pattern on the second substrate, as recited in independent Claims 1-4, 7, 15, 16, 19 and 20. In addition, Applicants submit that those documents also fail to disclose or suggest at least the features of preparing a mold having (i) an alignment pattern to be engaged with an alignment pattern formed on a substrate, and (ii) a second diffraction grating pattern, and positioning a first diffraction grating on the substrate and the second diffraction grating pattern to be spaced with respect to each other by engaging the alignment pattern of the substrate with the alignment pattern of the mold, as recited in independent Claim 11.


For the foregoing reasons, Applicants submit that the independent claims are allowable over the cited documents, and request withdrawal of the rejections under 35 U.S.C. § 103.

The remaining claims in the present application are dependent claims which depend from the independent claims discussed above, and thus are patentable over the applied documents for reasons noted above with respect to those independent claims. In addition, each recite features of the invention still further distinguishing it from the applied documents. Applicants request favorable and independent consideration thereof.

Applicants believe that all outstanding matters in this application have been attended to, and that the application is in condition for allowance. Accordingly, Applicants request a notice thereof.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,

  
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**VERSIONS WITH MARKINGS TO SHOW  
CHANGES MADE TO THE CLAIMS**

1. (Amended) A diffractive optical element having a diffraction grating portion which includes first and second diffraction gratings, the improvement residing in that:

the first diffraction grating and an alignment pattern are integrally formed on a first substrate and the second diffraction grating and an alignment pattern are integrally formed on a second substrate, and that the first and second [substrates] gratings are accumulated with a space therebetween and the first and second diffraction gratings are positioned so that the alignment pattern on the first substrate engages the alignment pattern on the second substrate;

wherein the first and second diffraction gratings are formed on different materials such that a largest optical path difference to be applied to light rays passing through the diffraction grating portion with respect to each of plural wavelengths, becomes equal to a multiple, by an integral number, of the corresponding one of the plural wavelengths.

2. (Amended) A diffractive optical element having a diffraction grating portion which includes first and second diffraction gratings, the improvement residing in that:

the first diffraction grating and an alignment pattern are integrally formed on a first substrate and the second diffraction grating and an alignment pattern are integrally formed on a second substrate, and that the first and second [substrates] gratings are accumulated with a space therebetween and the first and second diffraction gratings are positioned so that the alignment pattern on the first substrate engages the alignment pattern on the second substrate;

wherein the first and second diffraction gratings are formed on different materials such that a largest optical path difference to be applied to light rays passing through the diffraction grating portion with respect to each of plural wavelengths becomes equal to a multiple, by an integral number, of the corresponding one of the plural wavelengths, and the alignment patterns are formed outside optically effective regions of the first and second diffraction gratings.

3. (Amended) A diffractive optical element having a diffraction grating portion which includes first and second diffraction gratings, the improvement residing in that:

the first diffraction grating and an alignment pattern are integrally formed on a first substrate and the second diffraction grating and an alignment pattern are integrally formed on a second substrate, and that the first and second [substrates] gratings are accumulated with a space therebetween and the first and second diffraction gratings are

positioned so that the alignment pattern on the first substrate engages the alignment pattern on the second substrate;

wherein the first and second diffraction gratings are formed on different materials such that a diffraction efficiency of diffraction light of a particular order, with respect to each of plural wavelengths, becomes equal to or nearly equal to 100%.

4. (Amended) A diffractive optical element having a diffraction grating portion which includes first and second diffraction gratings, the improvement residing in that:

the first diffraction grating and an alignment pattern are integrally formed on a first substrate and the second diffraction grating and an alignment pattern are integrally formed on a second substrate, and that the first and second [substrates] gratings are accumulated with a space therebetween and the first and second diffraction gratings are positioned so that the alignment pattern on the first substrate engages the alignment pattern on the second substrate;

wherein the first and second diffraction gratings are formed on different materials such that a diffraction efficiency of diffraction light of a particular order, with respect to each of plural wavelengths, becomes equal to or nearly equal to 100%, and the alignment patterns are formed outside optically effective regions of the first and second diffraction gratings.



7. (Amended) A diffractive optical element having a diffraction grating portion which includes first and second diffraction gratings, the improvement residing in that:

the first diffraction grating and an alignment pattern are integrally formed on a first substrate and the second diffraction grating and an alignment pattern are integrally formed on a second substrate, and that the first and second [substrates] gratings are accumulated with a space therebetween and the first and second diffraction gratings are positioned so that the alignment pattern on the first substrate engages the alignment pattern on the second substrate,

wherein the alignment patterns have a sectional shape of one of a triangular shape, a trapezoidal shape and a semi-circular shape.

8. (Amended) A diffractive optical element having a diffraction grating portion which includes first and second diffraction gratings, the improvement residing in that:

the first diffraction grating and an alignment pattern are integrally formed on a first substrate and the second diffraction grating and an alignment pattern are integrally formed on a second substrate, and that the first and second [substrates] gratings are accumulated with a space therebetween and the first and second diffraction gratings are positioned so that the alignment pattern on the first substrate engages the alignment pattern on the second substrate,

wherein the alignment patterns have a sectional shape of one of a triangular shape, a trapezoidal shape and a semi-circular shape, and the alignment patterns are formed outside optically effective regions of the diffraction gratings.

15. (Amended) A diffractive optical element, comprising:

a diffraction grating portion which includes first and second diffraction gratings, with said first diffraction grating and an alignment pattern being formed on a first substrate and said second diffraction grating and an alignment pattern being formed on a second substrate, the first and second [substrates] gratings being accumulated with a space therebetween, and said first and second diffraction gratings being positioned so that the alignment pattern on the first substrate engages the alignment pattern on the second substrate,

wherein said first and second diffraction gratings are made of materials, respectively, which are different from each other, such that [an] a maximum optical path difference to be applied to light rays passing through the diffraction grating portion with respect to each of plural wavelengths, becomes equal to a multiple, by an integral number, of the corresponding one of the plural wavelengths.

16. (Amended) A diffractive optical element, comprising:

a diffraction grating portion which includes first and second diffraction gratings, said first diffraction grating and an alignment pattern being formed on a first

substrate and said second diffraction grating and an alignment pattern being formed on a second substrate, wherein the first and second [substrates] gratings being accumulated with a space therebetween, and wherein said first and second diffraction gratings being positioned so that the alignment pattern on the first substrate engages the alignment pattern on the second substrate,

wherein said first and second diffraction gratings are made of different materials, respectively, such that [an] a maximum optical path difference to be applied to light rays passing through the diffraction grating portion with respect to each of plural wavelengths, becomes equal to a multiple, by an integral number, of the corresponding one of the plural wavelengths, and wherein alignment patterns are formed outside optically effective regions of the first and second diffraction gratings.

19. (Amended) A diffractive optical element, comprising:

a diffraction grating portion which includes first and second diffraction gratings, with said first diffraction grating and alignment pattern being formed on a first substrate and said second diffraction grating and an alignment pattern being formed on a second substrate, the first and second [substrates] gratings being accumulated with a space therebetween, and said first and second diffraction gratings being positioned so that the alignment pattern on the first substrate engages the alignment pattern on the second substrate,

wherein the alignment patterns have a sectional shape of one of a triangular shape, a trapezoidal shape and a semi-circular shape.

20. (Amended) A diffractive optical element, comprising:

a diffraction grating portion which includes first and second diffraction gratings, with said first diffraction grating and an alignment pattern being formed on a first substrate and second diffraction grating and an alignment pattern being formed on a second substrate, the first and second [substrates] gratings being accumulated with a space therebetween, and said first and second diffraction gratings being positioned so that the alignment pattern on the first substrate engages the alignment pattern on the second substrate,

wherein the alignment patterns have a sectional shape of one of a triangular shape, a trapezoidal shape and a semi-circular shape, and wherein the alignment patterns are formed outside optically effective regions of said first and second diffraction gratings.